

# Installation and Operating manual

## SC02 Controller

For Split Solar

System



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## 1. Safety information

### 1.1 Installation and commissioning

- When laying cables, please ensure that no damage occurs to any of the constructional fire safety measures presented in the building.
- The controller must not be installed in rooms where easily inflammable gas mixtures are present or may occur.
- The permissible environmental conditions can't be exceeded at the site of installation.
- Before connecting the device, make sure that the energy supply matches the specifications that controller requires.
- All devices connected to the controller must conform to the technical specifications of the controller.
- All operations on an open regulator are only to be conducted cleared from the power supply. All safety regulations for working on the power supply are valid.
- Connecting and /or all operations that require opening the regulator (e.g. changing the fuse) are only to be conducted by specialists.

### 1.2 About this manual

This manual describes the installation, function and operation of a solar thermal controller.

When installing the remaining components e.g. the solar collectors, pump assemblies and the storage unit, are sure to observe the appropriate installation instructions provided by each manufacturer. Only trained professional personnel may only perform installation, electrical connection, commissioning and maintenance of the device. The professional personnel must be familiar with this manual and follow the instructions contained herein.

### 1.3 Liability waiver

The manufacturer cannot monitor the compliance with these instructions or the circumstances and methods used for installation, operation, utilization and maintenance of this controller. Improper installation can cause damages to material and persons.

This is the reason why we do not take over responsibility and liability for losses, damages or cost that might arise due to improper installation, operation or wrong utilization and maintenance or that occurs in some connection with the aforementioned.

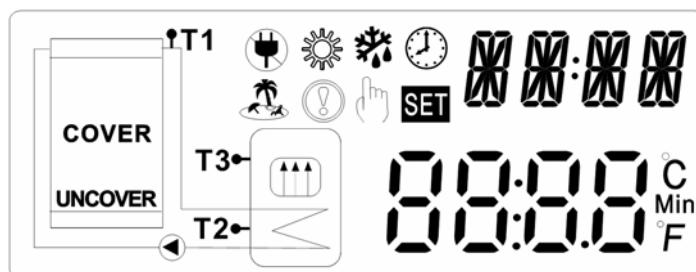
Moreover we do not take over liability for patent infringements or infringements – occurring in connection with the use of this controller- on third parties rights. The manufacturer preserves the right to put changes to product, technical date or

installation and operation instructions without prior notice. As soon as it becomes evident that safe operation is no longer possible (e.g. visible damage). Please immediate take the device out of operation. Note: ensure that the device cannot be accidentally placed into operation.

## **1.4 Important remark**

We have carefully checked the text and pictures of this manual and provided the best of our knowledge and ideas, however inevitable errors maybe exist. Please note that we cannot guarantee that this manual is given in the integrity of image and text, they are just some examples, and they apply only to our own system. Incorrect, incomplete and erroneous information and the resulting damage we do not take responsibility.

## **1.5 Signals Description**



Signals	Description
<b>COVER</b>	The curtain is in "Cover"
<b>UNCOVER</b>	The curtain is in "Uncover"
	No power supply for "Power1", power failure protection running
	Collector or tank over-heating protection running
	Collector anti-freezing protection running
	Holiday function running
	Signal for trouble or protection (will appear with other signals)
	Manual function running
	Auxiliary heating running
	The circulation pump is running when this signal is blinking



Safety instructions: This is a warning signal, it will cause personal injury and safety risks. Operating steps: Please follow this mark: "►". Note: This signal means important operating or functional information!

## 2. Installation and Connection

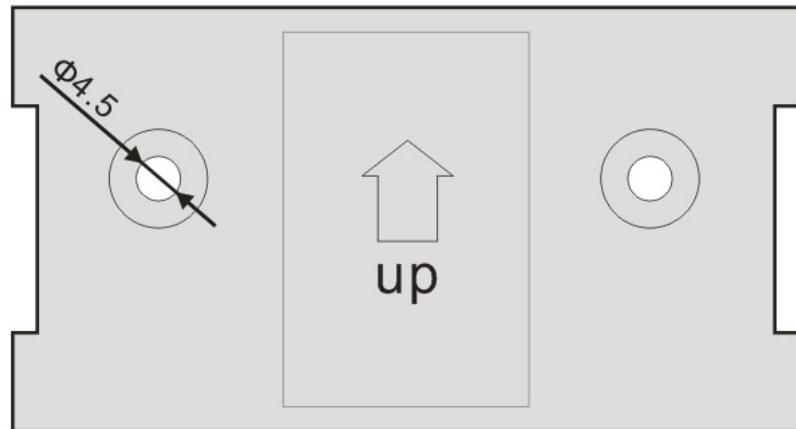
### 2.1 Controller installation

Please combine the fixing plate with the back of controller, make sure it is fixed.

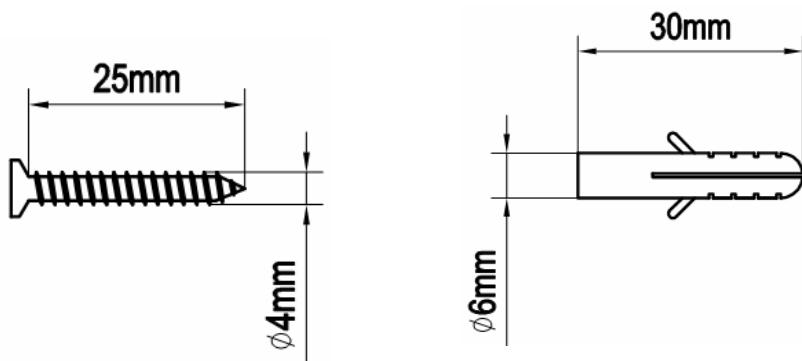
Note: 1. Self-tapping screw and Expansion pipe can be used for fixing to the wall.

The hole size is  $\phi$  7mm.

2. If you fix the controller to the water tank or other metal plate, the Self-tapping screw is the best choice. The hole size is  $\phi$  3mm.



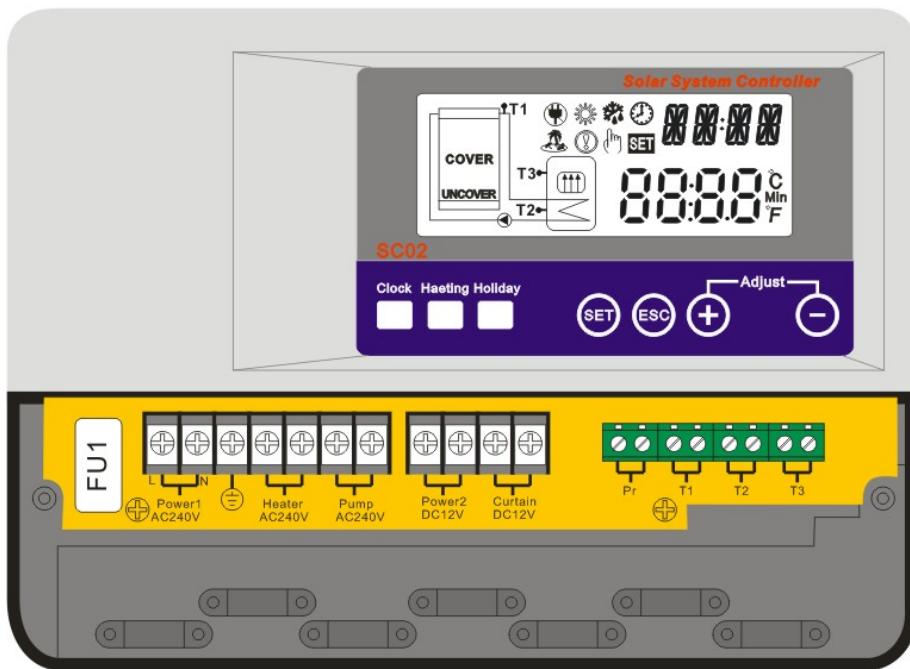
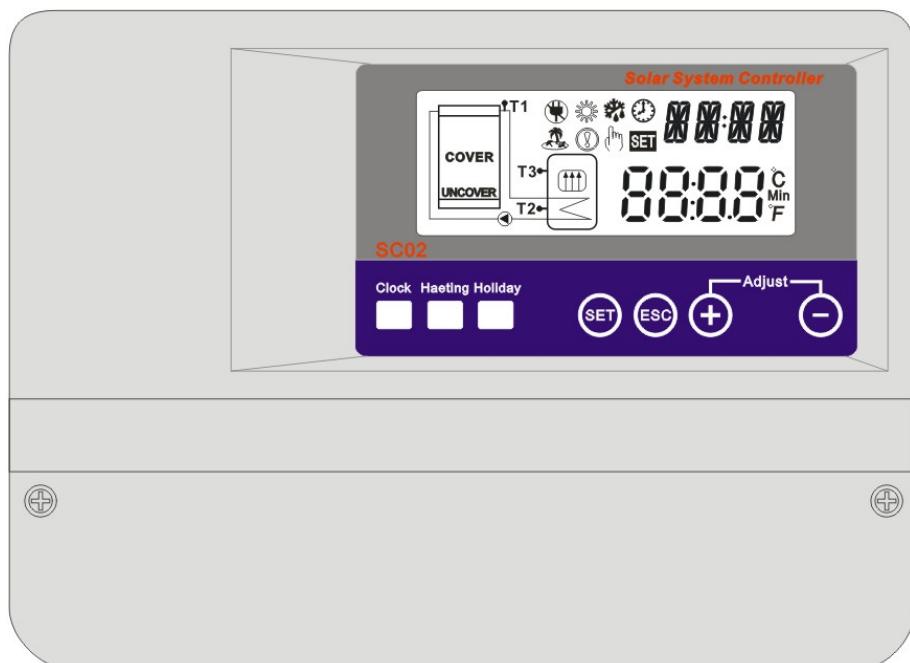
Fixing plate



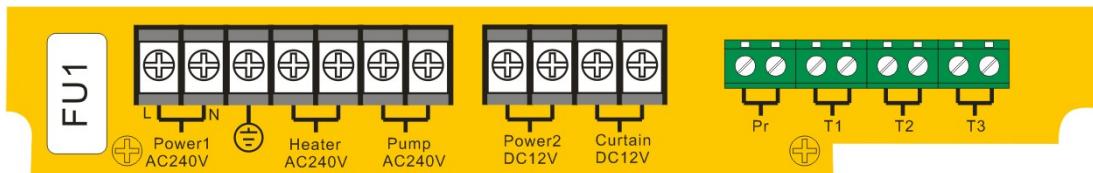
Self-tapping screw & Expansion pipe

## 2.2 Appearance and Wiring Terminal

### 2.2.1 Appearance



## 2.2.2 Wiring terminal



Note: FU1 is a 2A/240V fuse (this is protection for controller, does not matter with the output)

Catalog	Code	Name	Description
Power Input	Power1	Power supply 1	AC240V/50Hz/The power is determined by the outputs of both Heater and Pump
	Power2	Power supply 2	DC12V/The power is determined by the output of Curtain
Signal Input	Pr	Contact protection(can be connected to pressure protection switch)	Protection mode runs in open circuit, normally works in short circuit
	T1	Temperature sensor of the collector	PT1000
	T2	Temperature sensor at the bottom of the tank	NTC10K
	T3	Temperature sensor at the top of the tank	NTC10K
Outputs	Heater	Auxiliary heater	AC240V/Max. current limitation :10A
	Pump	Circulation pump	AC240V/ Max. current limitation :3A
	Curtain	Overheating protection	DC12V/ Max. current limitation :10A

Note: Power2 should be powered by UPS with Li battery is recommended to ensure power-off protection function is on. Once main power failed, the battery will take over main power for curtain to move on the “Cover” position.

## 2.3 Descriptions of Signal Input

### 2.3.1 Pressure sensor

Sensor connector: R1/4"  
Connector: waterproof.  
Connecting pressure:  $0.22 \pm 0.05$  Mpa  
Cut off pressure:  $0.18 \pm 0.05$  Mpa  
Maximum pressure: 1.2 Mpa  
Temperature range:  $-30^{\circ}\text{C} \sim 120^{\circ}\text{C}$

### 2.3.2 Temperature sensor

PT1000 sensor is required for "T1", suitable for any weather condition, temperature resistant:  $280^{\circ}\text{C}$ , does not matter for the positive and negative.  
NTC10K, B=3950 are required for T2 and T3, material is PVC, temperature resistant:  $105^{\circ}\text{C}$ , does not matter for the positive and negative.



Remove the device from the mains supply before opening the case A potentially defective sensor can be checked using an ohmmeter. To do this, the sensor must be disconnected, its resistance measured, and the value compared with the figures in the table below, small deviation ( $\pm 1\%$ ) is acceptable.

PT1000 resistance value

°C	0	10	20	30	40	50	60	70	80	90	100
Ω	1000	1039	1077	1116	1155	1194	1232	1270	1309	1347	1385

NTC 10K B=3950 resistance value

°C	0	10	20	30	40	50	60	70	80	90	100
Ω	33620	20174	12535	8037	5301	3588	2486	1759	1270	933	697



All sensor cables carry low voltage, and to avoid inductive effects, must not be laid close to 230 volt or 400-volt cables (minimum separation of 100mm)

If external inductive effects are existed, e.g. from heavy current cables, overhead train cables, transformer substations, radio and television devices, amateur radio stations, microwave devices etc. Then the cables to the sensors must be adequately shielded.

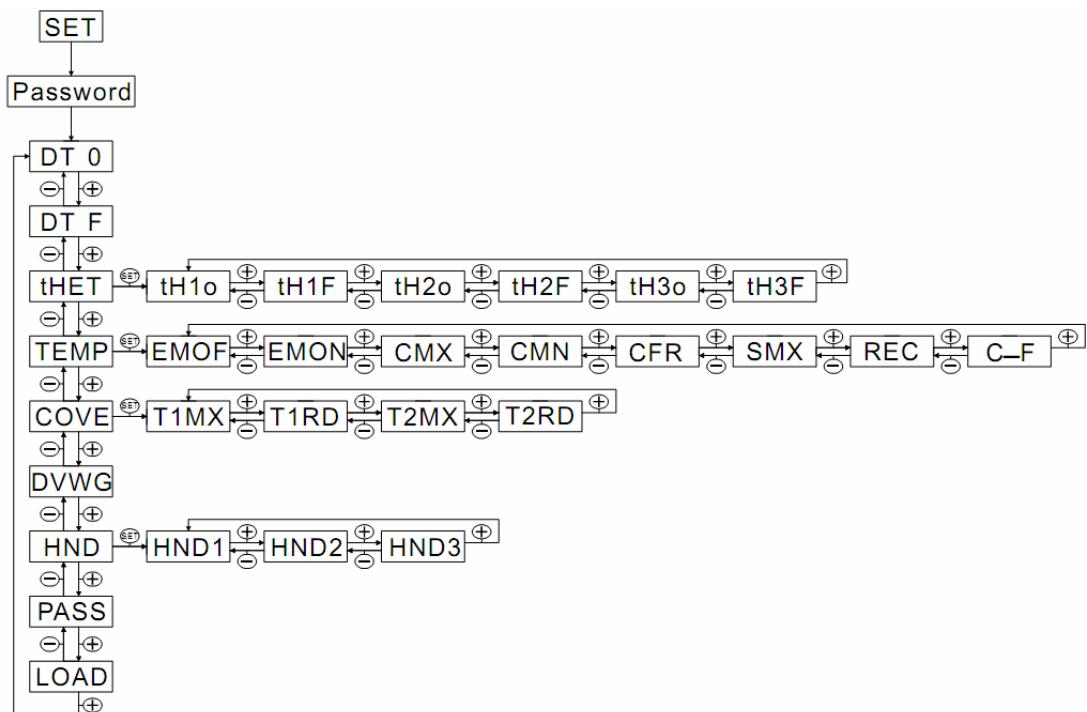
Sensor cables may be extended to a maximum length of ca. 100 meter, when cable's length is up to 50m, and then  $0.75\text{mm}^2$  cable should be used. When cable's length is up to 100m, and then  $1.5\text{mm}^2$  cables should be used.

### 3. Descriptions of menu and system



Please connect the sensor to the input ports and pump or switch valve to the output ports before supplying the main power. You can set the time, password and other dates which related to the system when the power on.

#### 3.1 Menu structure:



Sub-menu can set more details, please know more about it.

#### 3.2 Menu description

Code (main menu)	Code(sub- menu)	Instruction	State as delivered	Corresponding chapter
DT O		Switch-on temperature difference	8°C	4.3.1
DT F		Switch-off temperature difference	4°C	4.3.2
THET		Timing heating		4.4
	tH1o	Timing heating(first timing on)	04: 00, 40°C	4.4.1
	tH1F	Timing	05: 00, 45°C	4.4.2

		heating(first timing off)		
	tH2o	Timing heating(second timing on)	10: 00, 50°C	4.4.3
	tH2F	Timing heating(second timing off)	10: 00, 55°C	4.4.4
	tH3o	Timing heating(third timing on)	17: 00, 50°C	4.4.5
	tH3F	Timing heating(third timing off)	22: 00, 55°C	4.4.6
TEMP		Temperature		4.5
	EMOF	Collector maximum switch-off temperature	130	4.5.1
	EMON	Collector maximum switch-on temperature	120	4.5.2
	CMX	Maximum temperature of collector (Collector cooling function)	110	4.5.3
	CMN	Low temperature protection of collector		4.5.4
	CFR	Frost protection of collector		4.5.5
	SMX	Maximum temperature of tank	60	4.5.6
	REC	Tank re-cooling function	OFF	4.5.7
	C-F	Celsius and Fahrenheit temperature transferring		4.5.8
COVE		Temperature to cover		4.6
	T1MX	Collector temp. setting	100	4.6.1
	T1RD	Collector temp. difference setting	10	4.6.2
	T2MX	T2 temp. setting	80	4.6.3

	T2RD	T2 temp. difference setting	5	4.6.4
DVWG		Anti legionnaires' function	OFF	4.7
HND		Manual controlling		4.8
	HND1	Heater Manual controlling	OFF	4.8.1
	HND2	Pump Manual controlling	OFF	4.8.2
	HND3	Curtain Manual controlling	OFF	4.8.3
PASS		Password setting	0000	
LOAD		Recovery to factory set		

### **3.3 System description**

#### **3.3.1 Solar circuit pump (Pump) (See details in 4.3)**

The solar circuit pump (Pump) is switched on as soon as the switch-on temperature difference ( $\Delta T$  on) between the collector array (T1) and the storage tank (T2) is reached. If the temperature difference between the collector array (T1) and storage tank (T2) drops below the switch-off temperature difference, or the temperature of storage tank (T3) reaches the preset maximum storage temperature, then the solar circuit pump (R1) is switched off.

#### **3.3.2 Auxiliary heater (Heater) (See details in 4.4 tHET)**

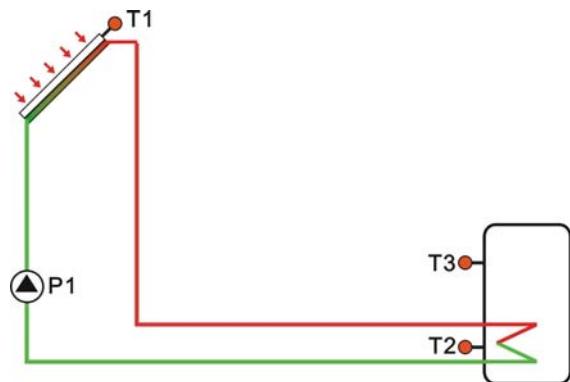
Within the preset time section of back-up heating, if the temperature T3 is below the switch-on temperature, then the circulation pump (H1) of back-up heating is triggered, when T3 is heated to the switch-off temperature, circulation pump H1 of back-up heating is ceased.

#### **3.3.3 Curtain control (Curtain) (See details in 4.7 COVE)**

When T1 or T2 above the setting, the curtain will cover; below the setting, the curtain will not cover.

When the “Power1” off, output “-、+” the curtain will cover;

When the “Pr” off, output “-、+” the curtain will cover



Pr: Protection terminal (protection when the pressure off)  
T1: Collector temp. sensor: PT1000  
T2: Tank temp. sensor(down): NTC10K  
T3: Tank temp. sensor(upside): NTC10K  
Heater: Auxiliary heater  
Pump: Circuit pump  
Curtain: Curtain

## 4. Controller functions

### 4.1 Access main menu

Under standby status, doing like following access main menu

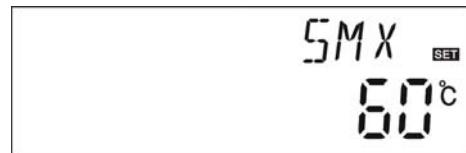
- Press “SET” button, “PWD 0000” displays on screen, the left first digital blinks, ask for entering password, factory default set password is “ 0000”
- Press “+”“-” button to enter first digital of password.
- Press “SET” button again, the second digital blinks
- Press “+”“-” button, to enter second digital of password
- Press “SET” button again, the third digital blinks
- Press “+”“-” button to enter the third digital of password
- Press “SET” button again, the fourth digital blinks
- Press “+”“-” button, to enter the fourth digital of password
- Press “SET” button again to access main menu
- Press “+”“-” button, can select the main menu
- Press “ESC” button to exit main menu



### 4.2 Access sub-menu

After selecting main menu, do like following access submenu

- Press “SET” button, to access submenu
- Press “+”“-” button to select submenu
- Press “SET” button again to access program, can adjust parameter value now
- Press “+”“-” button, to adjust the value of parameter
- Press “ESC” button, exit program of submenu
- Press “ESC” button again, to exit main menu.



For example: submenu

### 4.3 Main menu DT O & DT F Temperature difference function

#### Description:

Solar circuit pump P1 is triggered by the temperature difference function, so long as the temperature difference between collector and tank reaches the switch-on DT, solar circuit pump is triggered.

For example: the switch-on DT is 8°C, switch-off DT is 4°C, if the temperature in the

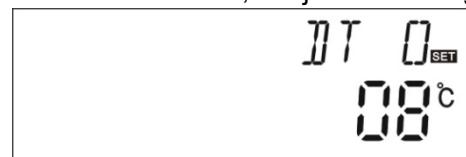
bottom part of tank is 20°C, then just when collector temperature rises up to 28°C, pump is triggered, and when collector temperature drops to 24°C, pump is ceased.

Note: the switch-on/off DT of 8 °C and 4 °C are standard system setting according to many years' experience, only in special application cases it needs to be changed, (e.g far distance heat transferring), normally it is recommend to use default set. Switch-on and switch-off DT are alternating set. To avoid mistake the minimum difference between two temperature differences ( $\Delta T$  on -  $\Delta T$  off) is set as 2°C.

#### **4.3.1 Setup the switch-on temperature difference:**

Under standby status, access main menu DT O,

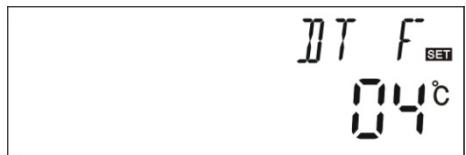
- Press "SET" button, to access settings program of DT O, "DT O 08°C" displays on screen, "08°C" blinks, the switch-on temperature difference can be set.
- Press "+" "-" button, to adjust the value of switch-on DT, adjustable range (OFF+2°C) ~ 20°C, factory setting is 8°C
- Press "ESC" button to exit this setting, parameter is saved automatically.



#### **4.3.2 Setup the switch-off temperature difference:**

Under standby status, access main menu DT F

- Press "SET" button, to access settings program of DT F, "DT F 04°C" displays on screen, "04°C" blinks, the switch-off temperature difference can be set.
- Press "+" "-" button to adjust the value of switch-off DT, adjustable range 0°C ~ (ON-2°C), factory set is 4°C.
- Press "ESC" to exit menu, or wait for 20 seconds to exit automatically, the setup parameters are saved automatically.



### **4.4 Main menu - THET timing heating**

#### **Description:**

Electrical heater, gas boiler or oil boiler can be integrated into solar system used as back-up of system, and they can be triggered automatically at preset time by preset temperature. Within a preset time section, when the temperature (T3) of top part of tank drops below the preset switching-on temperature of this function, back-up heating starts to work, when T3 rises up to the preset turning off temperature, back-up heating is stopped. Within 24 hours, three time sections can be set with this controller.

#### **Factory set:**

The first time section: back-up heating function starts at 4:00 and ends at 5:00 am. Within this time section, switch-on temperature is 40°C, switch-off temperature is 45°C. The second time section: from 10:00 to 10:00 am, it means there is no back-up heating

in this time.

The third time section: back-up heating function starts at 17:00 and ends at 22:00 pm. Within this time section, the switch-on temperature is 50°C, switch-off temperature is 55°C.

The switch-on temperature adjustable range: 10°C ~ (OFF-2 °C)  
The switch-off temperature adjustable range: (ON+2 °C) ~ 80°C

If you want to shut off one timing heating, then you can set the turning on time and turning off time same value (for example, the second time section no this function, then you can set turning on/off time is 10:00 ~ 10:00)

When time is outside of the preset time section, back-up heating doesn't work automatically even when the tank temperature reaches the switch –on temperature of heating.

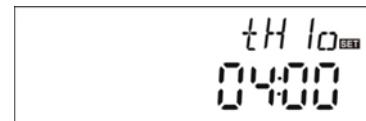
**Note:**

- When there is no sensor installed in the top part of tank (no T3 sensor), controller will take the signal of T2 (sensor in bottom of tank) automatically to control this function.
- The time in this controlled is 24 hours, when you set time section, the switch-off time of heating should be larger than switch-on time. For example: if you set the switch-on time of heating is at 17:00, but switch-off time of heating is 6:00, then this setting doesn't take effect, that means within this time section, heating function doesn't work. The correct set is like flowing: it should be divided into two time sections, one time section is from 17:00 to 23:59, the other time section is from 00:00 to 06:00.

#### **4.4.1 Setup the switch-on first timing heating:**

Under standby status, access main menu THET

► Press “SET” button, access THET program to set parameter, “tH 1o 04:00” displays on screen, the switch-on time and temperature for first time section of heating function can be set



► Repress “SET” button, “04” of hour time blinks on screen

► Press “+”“-” button to adjust hour of time

► Repress “SET” button again, “00” of minute time blinks on screen

► Press “+”“-” button to adjust minute of time

► Repress “SET” button, temperature “40°C” blinks on screen

► Press “+”“-” button, to set the switch-on temperature of heating

► Then, Press “ESC” to exit this set and to access the switch-off time and temperature

set

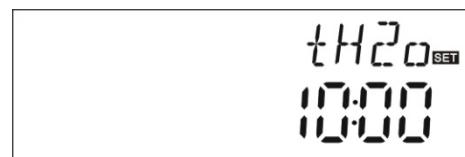
#### 4.4.2 Setup the switch-off first timing heating:

- ▶ Press “+” button, “tH 1F 05:00” displays on screen, the switch-off time and temperature for first time section of heating function can be set
- ▶ Press “SET” button, “05” of hour time blinks on screen.
- ▶ Press “+”“-” button to adjust hour of time
- ▶ Repress “SET” button, “00” of minute time blinks on screen
- ▶ Press “+”“-” button to set minute of time
- ▶ Repress “SET” button, temperature “45°C” blinks on screen
- ▶ Press “+”“-” button, to set switch-off temperature of heating
- ▶ Press “ESC” to exit this set program, parameters are saved automatically



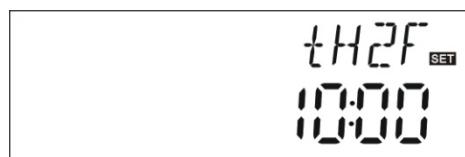
#### 4.4.3 Setup the switch-on second timing heating:

- ▶ Press “+” button, “tH 2o 10:00” displays on screen, the switch-on time and temperature for the second time section of heating function can be set
- ▶ Press “SET” button, “10” of hour time blinks on screen
- ▶ Press “+”“-” button to adjust hour of time
- ▶ Repress “SET” button, “00” of minute time blinks on screen
- ▶ Press “+”“-” button to adjust minute of time
- ▶ Repress “SET” button, temperature “50°C” blinks on screen
- ▶ Press “+”“-” button to adjust switch-on temperature of heating
- ▶ Then press “ESC” to exit this set and to access the switch-off time and temperature set



#### 4.4.4 Setup the switch-off second timing heating:

- ▶ Press “+” button, “tH 2F 10:00” displays on screen, set the switch-off time and temperature of second time section of heating function
- ▶ Press “SET” button, “10” of hour time blinks on screen
- ▶ Press “+”“-” button to adjust hour of time
- ▶ Repress “SET” button, “00” of minute time blinks on screen
- ▶ Press “+”“-” button to adjust minute of time

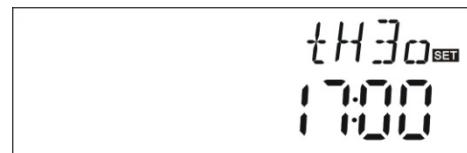


- Repress “SET” button, temperature “55°C” blinks on screen
- Press “+”“-” button, to adjust switch-off temperature of heating
- Press “ESC” to exit this set program, parameter is saved automatically

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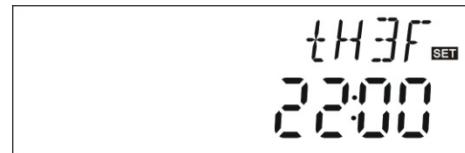
#### **4.4.5 Setup the switch-on third timing heating:**

- Press “+” button, “tH 3o 17:00” displays on screen, set the switch-on time and temperature of the third time section of heating function
- Press “SET” button, “17” of hour time blinks on screen
- Press “+”“-” button, to adjust hour of time
- Repress “SET” button, “00” of minute time blinks on screen
- Press “+”“-” button, to adjust minute of time
- Repress “SET” button, temperature “50°C” blinks on screen
- Press “+”“-” button, to adjust switch-on temperature of heating
- Press “ESC” to exit this set program and to the switch-off time and temperature set



#### **4.4.6 Setup the switch-off third timing heating:**

- Press “+” button, “tH 3F 22:00” displays on screen, the switch-off time and temperature of the third time section of heating function can be set
- Press “SET” button, “22” of hour time blinks on screen
- Press “+”“-” button, to adjust hour of time
- Repress “SET” button, “00” of minute time blinks on screen
- Press “+”“-” button to adjust minute of time
- Repress “SET” button, temperature “55°C” blinks on screen
- Press “+”“-” button to adjust switch-off temperature of heating
- Press “ESC” to exit menu, or wait for 20 seconds, set parameters are saved automatically



Note: when no gas or oil boiler is installed in system, electrical heater can be installed as back-up device, when electrical heater is in operation status, signal  blinks on screen.

If customer use electrical heater as back-up, please according to the power of electrical heater to equip corresponding safety devices.

### **4.5 TEMP Temperature main menu**

For every system, the factory set parameters are in the best condition that is fully integrated into the entire solar system. But these parameters can also be set

individually to cater the special requirements, please carefully observe the operation data of system components after setting.

Note: parameters that can be set depend on the selected system, not all the parameters can be adjusted in a solar system.

Following submenu can be access though TEMP main menu.

#### **4.5.1 EMOF Collector emergency shutdown function activated**

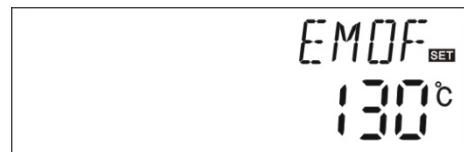
##### **Function description:**

When collector temperature rises up to this maximum switch-off limited temperature (EM), this function is activated, solar circulation pump is stopped in order to avoid the damage of system other components caused by high temperature. The adjustable range of EMOF temperature is (120 °C ~ 200 °C), factory set is 130 °C. If the temperature of collector rises up to EMOF limited temperature, solar circuit pump is ceased, but when collector temperature drops emergency shutdown exit temperature EMON (factory set is 120°C) , solar circuit pump will be reset, and this function is deactivated.

##### **Setup steps:**

to access main menu TEMP, then select submenu EMOF (see 4.1 and 4.2) , “EMOF 130°C” displays on screen

- ▶ Press “SET” button, parameter “130 °C” blinks.
- ▶ Press “+,-“ button, to adjust this maximum switch-off temperature, adjust range (ON+3 °C) ~200 °C, factory set is 130 °C
- ▶ Repress “SET” button to activate and deactivate this function, if deactivate the function, “EMOF - - -” displays on screen.
- ▶ Press “ESC” button to exit menu or wait for 20 seconds to exit automatically, set parameters are saved automatically.



#### **4.5.2 EMON Collector emergency shutdown function exit**

##### **Setup steps:**

to access main menu TEMP, then select submenu EMON (see 4.1 and 4.2) , “EMON 120°C” displays on screen



- ▶ Press “SET” button, parameter “120°C” blinks.
- ▶ Press “+,-“ button, to adjust this maximum exit temperature, adjust range (OF-3 °C) ~200 °C, factory set is 120°C
- ▶ Repress “SET” button to activate and deactivate this function, if deactivate the function, “EMON - - -” displays on screen.

► Press “ESC” button to exit menu or wait for 20 seconds to exit automatically, set parameters are saved automatically.

- ☀ ☺ When these two signals of EM blink on the screen, it indicates this function is in activated, and at this moment temperature of tanks reaches to its maximum limited temperature
- ☺ When only this signal of EM blinks on the screen, it indicates this function is also activated, but temperature of tank doesn't reach to its maximum limited temperature

#### 4.5.3 CMX Maximum limited collector temperature (collector cooling function)

##### Function description:

The collector cooling function delays the vaporization of the heat transfer fluid. Shortly before reaching the maximum temperature of the collector, the solar pump starts working in order to cool down the heat transfer fluid using the heat losses occurring in pipelines and storage cylinder.

When tank temperature rises to its preset maximal temperature, solar circuit pump is ceased compulsively even the temperature difference is satisfied. If the sunshine is very good, as a result collector temperature will rise continuously, when collector temperature rises up to its maximal temperature, solar pump will be triggered again even at the case that tank temperature is already to its maximal temperature. And solar pump works until the temperature of collector drops since this reversed circulation or when tank temperature rises its emergency temperature (95°C).

When ☀ displays, and ☺ blinks on the screen, it indicates that tank emergency temperature reaches, tank temperature is  $\geq 95^{\circ}\text{C}$

##### Setup steps:

To access main menu TEMP, then select submenu CMX “CMX 110°C” displays on screen



► Press “SET” button, parameter “110°C” blinks.

► Press “+”“-” button, to adjust the collector

protection temperature, adjustable range

(100°C ~ 190°C) , factory set is 110°C

► Repress “SET” button, activate and deactivate this function, if deactivate the function, “CMX - - -” displays on screen.

► Press “ESC” button to exit the menu or wait for 20 seconds to exit automatically, parameters are saved automatically.

- ☀ CMX signal displays on screen, it indicates that this function is in activated.

#### 4.5.4 CMN low temperature protection of collector

##### Description:

When the temperature of collector is below preset CMN temperatures, solar circuit pump is ceased, even when the temperature difference between collector and tank exceeds switch-on temperature difference, solar pump doesn't work yet. When temperature of collector is 3°C higher than the preset CMN temperature, solar circulation pump is restarted, controller exits this program.

##### Setup steps:

To access main menu TEMP, then select submenu CMN, “CMN - - -” displays on screen, default set is off.

► Press “SET” button, default off signal “- - -” blinks on screen.

► Repress “SET” button, to activate and deactivate this function



► Press “+”“-” button, to adjust the low protection temperature of collector CMN,

adjustable range (00°C ~ 90°C), after activate the function, factory set is 10°C

► Press “ESC” button to exit the menu or wait for 20 seconds to exit automatically, parameters are saved automatically.



CMN signal displays on screen, it indicates that this function is in activated.

#### 4.5.5 CFR frost protection of collector

##### Description:

In winter when the temperature of collector is below the preset frost protection temperature (factory set is 4°C), Solar circuit pump is triggered. Besides when tank temperature (T2) drops to 4°C, electrical heater is triggered automatically and it is in operation until T2 is heated up to 20 °C or it is stopped when program of CFR is exited. When collector temperature rises up to 7 °C, solar circuit pump is ceased, program of CFR exits automatically.

This function is used in system, which use water as heat transfer liquid, to avoid the freezing of solar heat transfer fluid.

##### Setup steps:

To access main menu TEMP, then select submenu CFR, “CFR - - -” displays on screen, default set is off.



► Press “SET” button, default off “- - -” blinks.

► Repress “SET” button, to activate or deactivate this function

► Press “+”“-” button, to adjust the frost protection function, adjustable range is

(-10°C~10°C) , after function activated, default set is 4°C

► Press “ESC” button to exit the menu or wait for 20 seconds to exit automatically, parameters are saved automatically.

 CFR signal displays on screen, it indicates that this function is in activated.

**Note:** this function is only available in special solar system which using no-anti-freezing liquid; this kind of system is only suitable in area where the ambient temperature is near to 0°C in only few days. If safety requirement is very high, then anti-freezing is necessary, we suggest using suitable anti-freezing liquid to avoid frost problem.

#### **4.5.6 SMX Maximum temperature of tank**

##### **Description:**

When the DT between collector T1 and Tank 2 caters the switch-on DT of circulation, solar pump is triggered, but in order to avoid the high temperature inside tank, controller will check whether the temperature (T3) of top part of tank is higher than maximum temperature of tank, when T3 is higher than preset SMX temperature, solar pump is ceased even at the case that DT caters condition. When tank temperature drops and is 2°C below the SMX, solar pump restarts when DT caters condition.

##### **Setup steps:**

To access main menu TEMP, then select submenu SMX, “SMX 60°C” displays on screen.

► Press “SET” button, parameter “60°C” blinks

► Press “+”“-” button to adjust the value of maximum temperature of tank1 adjustable

range is (2°C~95°C) , default set is 60°C

► Repress “SET” button to activate and deactivate this function, if function deactivated, “SMX - - -” displays on the screen.

► Press “ESC” button to exit the menu or wait for 20 seconds to exit automatically, parameters are saved automatically.



 SMX signal displays on screen, it indicates that this function is in activated.

#### **4.5.7 REC Tank re-cooling function**

##### **Description:**

If tank temperature is over tank's maximum temperature, and at the same time, collector temperature is 5°C lower than tank temperature, then solar pump is triggered, through this reversed circulation, tank temperature is reduced by heat loss occurs in collector, solar pump keep in working until tank temperature drops below its maximum temperature.

**Setup steps:**

To access main menu TEMP, then select submenu REC, “REC OFF” displays on screen, default set is off.



- Press “SET” button, parameter “OFF” blinks on screen
- Repress “SET” button to activate or deactivate this function, after function activated; factory set is “REC ON”
- Press “ESC” button to exit the menu or wait for 20 seconds to exit automatically, parameters are saved automatically.



REC signal displays on screen, it indicates that this function is in activated.

#### **4.5.8 C- F Celsius and Fahrenheit temperature transferring**

**Setup steps:**

To access main menu TEMP, then select submenu C-F, “C-F °C” displays on screen.

- Press “SET” button, parameter “°C” blinks on the screen.
- Press “+” button, to select between Celsius and Fahrenheit temperature, factory set is °C
- Press “ESC” button to exit menu or wait for 20 seconds to exit automatically, parameters are saved automatically.

### **4.6 COVE Curtain control**

**Description:**

When the T1 or T2 reach the setting(T1MX、T2MX), output“-、+” screen display “COVER”, when the T1 or T2 below the setting(T1MX—T1RD、T2MX —T2RD), output “+、-” screen display “UNCOVER”.

#### **4.6.1 T1MX T1 max value set**

Select T1MX(T1 max value set)sub-menu, the screen display “T1MX 100°C”, factory set:“100°C”

- Press “SET” button, the “100°C” blinks on screen
- Press “+”“-” button, adjust the T1 max temperature setting, the range is (60°C~150°C)
- Press “ESC” button to quit the menu, or wait for 20 seconds to exit automatically, parameters are saved automatically.



#### 4.6.2 T1RD T1 return difference set

Select T1RD(T1 return difference set) sub-menu, the screen display“T1RD 10°C”, factory set:“10°C”

- ▶ Press “SET” button, the “10°C” blinks on screen
- ▶ Press“+”“—” button, adjust T1 return difference set, the range is (5°C~30°C)
- ▶ Press “ESC” button to quit the menu, or wait for 20 seconds to exit automatically, parameters are saved automatically.



#### 4.6.3 T2MX T2 Max value set

Note: the value of T2MX must less than T1MX.

Select T2MX(T2 max value set) sub-menu, the screen display “T2MX 80°C”, factory set:“80°C”

- ▶ Press “SET” button, the “80°C” blinks on screen
- ▶ Press “+”“—” button, adjust the T2 max temperature setting, the range is (40°C~99°C)
- ▶ Press “ESC” button to quit the menu, or wait for 20 seconds to exit automatically, parameters are saved automatically.



#### 4.6.4 T2RD T2 return difference set

Select T2RD(T2 return difference set) sub-menu, the screen display“T2RD 5°C”, factory set:“5°C”

- ▶ Press “SET” button, the “5°C” blinks on screen
- ▶ Press“+”“—” button, adjust T2 return difference set, the range is (5°C~30°C)
- ▶ Press “ESC” button to quit the menu, or wait for 20 seconds to exit automatically, parameters are saved automatically.



### 4.7 DVWG Anti-Legionella function

#### Description:

In order to avoid occurring bacteria in water tank when the temperature of tank is lower for a long time, controller will check the temperature of tank every 7 days in a period automatically, if the temperature of tank is never over 70°C during this period, then at the factory set default time of 01:00 on the seventh day of the period auxiliary heating system is triggered automatically to heat water until it rises up to 70°C, bacteria is killed by high temperature, where after function is deactivated.

#### Setup steps:

To access main menu FUN, then select submenu DVWG, “DVWG OFF” displays on screen. Default set is “OFF”.

- ▶ Press “SET” button, parameter “OFF” blinks on the screen.
- ▶ Repress “+”“-”button, “DVWG ON” blinks on the screen, function is triggered.
- ▶ Press “ESC” button to exit the menu or wait for 20 seconds to exit automatically, parameters are saved automatically.



## 4.8 HND Manual mode

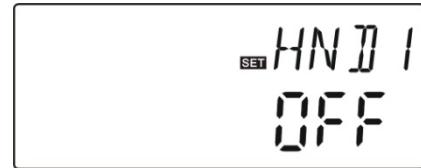
When using this controller first time or when debugging this controller, output of this controller (Pump, Heater, Curtain) can be triggered manually. “On, OFF” control.

To access main menu HND

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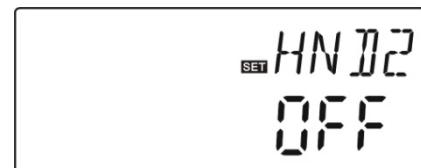
### 4.8.1 HND1 manual (Pump)

- ▶ Press “SET” button, “HND1 off” displays on the screen, “Pump” output manually set
- ▶ Repress “SET” button, “HND1 on” displays on the screen, “Pump” output is switched-on
- ▶ Repress “SET” again, “HND1 off” displays, “Pump” output is switched-off
- ▶ Press “ESC” to exit “Pump” set program



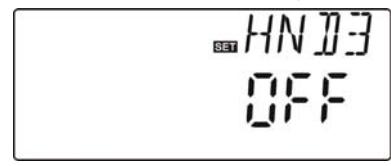
### 4.8.2 HND2 manual (Heater)

- ▶ Press “+” button, “HND2 off” displays on the screen, “Heater” output manually set
- ▶ Press “SET” button, “HND2on” displays on the screen, “Heater” output is switched-on
- ▶ Repress “SET” again, “HND2off” displays, “Heater” output is switched-off
- ▶ Press “ESC” to exit “Heater” set program



### 4.8.3 HND3 manual (Curtain)

- ▶ Press “+” button, “HND3 off” displays on the screen, “Curtain” output manually set
- ▶ Press “SET” button, “HND3 on” displays on the screen, “Curtain” output is switched-on
- ▶ Repress “SET” again, “HND3 off” displays, “Curtain” output is switched-off
- ▶ Press “ESC” to exit “Curtain” set program



**Note:** When manual mode is  activated, signal displays on the screen, after 15 minutes all outputs are switched-off, controller exits manual mode automatically.

## 4.9 PASS Password setting

### Setup steps:

To access main menu PASS,

- Press “SET” button, “PWDC 0000”, the left digital blinks, ask for to enter the password, factory set is “0000”
- Press “+”“-” button to enter the first digital
- Repress “SET” button, the second digital blinks
- Press “+”“-” button to enter the second digital
- Repress “SET” button, the third digital blinks
- Press “+”“-” button to enter the third digital
- Repress “SET” button, the fourth digital blinks
- Press “+”“-” button to enter the fourth digital
- Press “SET” button, “PWDN 0000” displays on the screen, ask for entering a new password, doing as above to enter the new password
- Press “SET” button, “PWDG 0000” displays on the screen, asking for reentering the new password, doing as above to reenter the new password, “PWOK” displays on the screen to indicate reentering password successfully.
- Press “ESC” button to exit set program or wait for 20 seconds to exit automatically.



### Warning!

If the password is forgot, it is not possible to recover, but you can recover the password to factory set, then you can reedit a password like above descript steps, doing like following to recover to factory set.

- Open cover in the front of the display, press  and hold on, then repress the recovery button, which on the display plate.
- Buzzer makes “du - - -” 3 times, then release  button. Controller recovers to factory set, a new password can be reset now.

## 4.10 LOAD Recovery factory setting

### Setup steps:

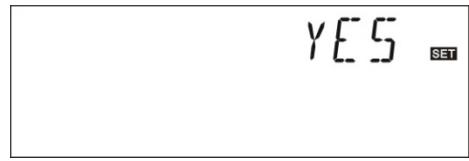
To access main menu REST,

► Press “SET” button, “YES” displays on the screen.

► Hold down “SET” button, buzzer makes “du ---” 3 times, then release “SET” button.

Controller recovers to factory set, new parameters can be reset now.

► Press “ESC” button to exit set program or wait for 20 seconds to exit automatically.



## 4.11 Manual heating

### Description:

Electrical heater, gas or oil boiler can be as back-up devices in a solar system, this controller can achieve constant temperature controlling, when controller gets temperature signal of top part tank (T3) is 2°C below the preset temperature, back-up heating will be triggered. When temperature of top part tank (T3) reaches to the preset temperature, heating is ceased.

Conditions for triggering manual heating function: the setting temperature should be 2°C higher than tank temperature.

### Activate/deactivate the function:

► Press “Heating” button, temperature “60°C” blinks on the screen.

► Press “+”“-” button to adjust switch-on temperature, adjustable range 10°C~80°C, factory set is 60°C.

After 20 seconds, this function is activated, signal displays on the screen, and heating signal blinks also.

► Press “Heating” button again, to switch-off manual heating function.

**Note:** Manual heating can only heat tank one time, after manual heating is triggered, when temperature of tank rises up to the preset temperature, manual heating ceases, and manual heating function will be deactivated automatically, if customer wants to heat again, you need redo according to above steps.

## 4.12 Holiday function

### Description:

When this function is running, the curtain is under “cover” state avoiding the over-heating problem.

Please run this function when:

- You will go for a holiday or not at home for a long time;
- No requirement of using hot water for a long time.

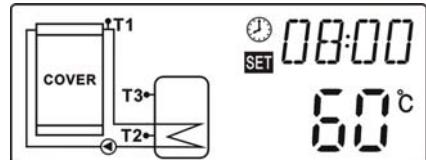
Run/Close this function:

- Press “Holiday” button 3 seconds,  blinks on screen as well as “07”.
- Press “+”“-” button, adjust the days for holiday, the range is “1—60” days.
- Press “Holiday” button 3 seconds, no  on the screen, this function is closed.

Note: Only on this function when no stay at home long period, Ensure to exit this function when you back home!! If over 60days of holiday, shut down main power supply and water source, meanwhile the curtain on the cover position as over-heating protection.

## **4.13 Clock setting**

- Press “clock” button, time displayed on screen, “00” blinks for HOUR set.
- Press “+”“-” button, adjust the HOUR.
- Press “Clock” button, “00” blinks for MINUTE set
- Press “+”“-” button, adjust the MINUTE.
- Press “ESC” button to exit setting program or wait for 20 seconds to exit automatically.



## **4.14 Temperature query function**

Under standby status,

- Press “+”“-” button and check the value of temperature sensors T1~ T3

When checking temperature, T1 – T3 will displays one by one, corresponding sensor signal  blinks.

## **5. Protection function**

### **5.1 Memory protection**

In case power failure occurs, the controller keeps the parameter settings unchanged.

### **5.2 Screen protection**

When no any press on button for 3 minutes, screen protection is activated automatically, and then LCD lighting lamp is switched-off. Through press any button to light LCD lamp again.

## 6. Trouble shooting

### 6.1 Trouble protection

When there is a break or short circuit between the connection of temperature sensors, controller switches off the corresponding functions and no more output signals are given, at the same time error signals  are showed on the display.

If control unit does not work correctly, please check following points.

Error message on LCD screen	Meaning	Output state		
		Heater	Pump	Curtain
 T1 - - -	T1 sensor problem	√	×	“-、+”
 T2 - - -	T2 sensor problem	√	×	“-、+”
 T3 - - -	T3 sensor problem	×	√	√
	Power1 (been Cut-off)	×	×	“-、+”
 E4	Pr (Open circuit)	×	×	“-、+”

Note: “√” means run automatically, “×” means no output. “-、+”means curtain on the cover position.

### 6.2 Trouble checking

The controller is quality product, conceived for years of continuous trouble-free operation. If a problem occurs, the cause of the problem very often lies not in the controller but in the peripheral components. The following description of some well-known problems should help the installer and operator to isolate the problem, so that the system can be place back into operation as quickly as possible and to avoid the unnecessary costs. Of course, not all possible problems can be listed here. However, most of the normal problems encountered with the controller can be found in the list below, only return the controller to seller when you are absolutely sure that none of the problems listed below is responsible for the fault.

Symptoms	Secondary symptoms	Possible cause	Procedure
Controller does not appear to function at all	Display shows nothing, no display illumination	Controller power supply is interrupted or program is out of work	Check the controller power cable Press reset button
The solar pump doesn't operate, despite the fact that switch-on conditions are satisfied	The pump symbol in the display blinks	Pump power supply is interrupted	Check the pump power cable
Pump doesn't operate	The pump symbol in the display doesn't blink.  Lighted or  blinks	The maximum storage tank temperature (SMX) has been reached The maximum collector temperature (EM) has been reached.	No fault
	 T1- -- Error message displays on the screen	Fault (short circuit or open circuit) in a temperature sensor	On the controller, request the current values from all connected temperature sensors, replace all defective sensors and /or cabling.
The solar pumps operated, despite the fact that the switch-on conditions are not satisfied.	The pump symbol in the display blinks.	Holiday function or Frost protection function or tank re-cooling function is activated.	No problem, it is normal. If necessary to deactivate the corresponding functions.
One function can't be activated	There is no function selection in submenu	All inputs and outputs are used; inputs and outputs can't be used doubly.	No fault on controller

## 7. Quality Guarantee

Manufacturer provides following quality responsibilities to end-users: within the period of quality responsibilities, manufacturer will exclude the failure caused by production and material selection. A correct installation will not lead to failure. When a user takes incorrect handling way, incorrect installation, improper or crud handling, wrong connection of sensor in system and incorrect operation, the quality responsibility is invalid for them. The warranty expires within 12 months after the date of purchasing the controller.

## 8. Technical data

Parameter Name	data
Dimension	200mm*146mm*45mm
Power supply	AC220V±10%
Power dissipation	< 3W
Temperature measurement Accuracy	±2°C
Collector temperature measurement range	-10~220°C
Tank or piping temperature measurement range	0~110°C
Circulation pump	3pcs , ≤ 300W
Heating booster	1pcs , ≤ 1500W
Input signal	Collector: 1pcs PT1000 sensor cable 500oC (Silicon wire≤280°C) Water tank: 2pcs NTC10K, B=3950 sensor ≤135°C (PVCwire≤105°C) Pressure protection: ≥0.22Mpa—on ,≤0.18Mpa—off
Output signal	Output port(Heater): AC240V, 10A. Output port (Pump): AC240V, 3A. Output port (Curtain): DC12V, 10A.
Temperature condition	-10~50°C
Waterproof level	IP40

## **9. Packing list**

<b>Parts</b>	<b>Quantity</b>	<b>Picture</b>
Solar controller(SC02)	1pcs	
User manual	1pcs	
PT1000 sensor (φ6*50mm, cable length:1.5m)	1pcs	
NTC10K(φ6*50mm, cable length:1.5m)	2pcs	
Pressure sensor	1pcs	
Plastic expansion pipe	4pcs	
Flat-head screw	4pcs	

## **10. Optional parts list**

<b>Parts</b>	<b>Size</b>	<b>Picture</b>
Power supply with adapter and Li Battery	AC240V-DC12V/2A, for max. 5*HFC-2-S	
	AC240V-DC12V/5A, for max 12*HFC-2-S	
	AC240V-DC12V/10A, for max 25*HFC-2-S	
Power Plug	AC240V	